: What is the symptoms, problems and treatments framework?

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Symptoms, problems, and treatments (SPT) is a diagnostic reasoning and problem-solving framework. The starting point in a diagnostic reasoning framework is the identification of symptoms. Symptoms are evidence or manifestations of malfunctioning. A specific symptom is a departure from normal functioning. For example, sales trends, relative profitability, and employee turnover are common symptoms or indicators relevant to the organizational system problem domain. Groups of symptoms may be identified as indicators of specific problems in a given domain. A symptom or a group of symptoms identify a problem or set of problems that should be treated or resolved. Diagnostic errors can occur using SPT due to faulty knowledge, faulty data gathering, biases, logic and reasoning problems, and faulty information processing.

To help structure diagnostic knowledge about problems relevant to managers in organizations it seems reasonable to classify the problems into the following six areas or domains: 1. individual organization members/participants; 2. teams; 3. functional departments/units; 4. channels; 5. organizational processes and systems; and 6. environmental interactions. Advantages of using a well-designed and researched knowledge-driven DSS include increased reliability, reduced errors, reduced costs, greater reliability based upon multiple sources of expertise, and reduced chance of missing symptoms and screening factors.

Symptoms

A common symptom category refers to changes in a measure of individual or organizational effectiveness. A number of authors have reviewed indicators and measures of effectiveness (cf., Price, 1968; Campbell, 1977; Cameron, 1978; Steers, 1977). These reviews provide an initial source for identifying a list of symptoms and indica-tors of organizational problems. Measures, standards, and norms for interpreting symptoms are not as well defined (cf., Steers, 1975). The state of current know- ledge about symptoms creates a major problem that.must be overcome before the SPT framework can be used to develop management expert systems. In the following paragraphs, examples and problems associated with six major categories of symptoms are discussed.

Measures of individual and collective employee behavior can frequently indicate problems. Absenteeism and accident records and rates, negative verbal of physi-cal behaviors, and on-the-job work behavior are examples of symptoms and indica-tors. Problems associated with measuring symptoms can be demonstrated by focusing on absenteeism. In measuring absenteeism, one might look at the number of days lost per quarter for an individual or for the entire organization. But, in evaluating a problem in an organizational systems' domain, it may be more appropriate to look at

the percentage of employees absent with corrections for seasonal changes. Also in evaluating absenteeism, it will be necessary to make comparisons with industry norms, historical company rates, and targeted levels.

Measures of individual, unit and system efficiency can provide symptomatic information in a number of problem domains. Efficiency ratios, such as administrative/ staff ratios or direct/indirect labor ratios may indicate problems in organizational systems needing correction. Norms for indicators including ratios for diff-erent industries and different organizational systems will be needed to assess the magnitude of a specific organizational problem. The magnitude of the problem will have implications for specifying an appropriate treatment.

A major category of symptoms is employee and stakeholder attitudes. Survey instruments, interviews, and observations may be needed to provide data for an expert system. To be useful, the meaning of such data values needs standardization and norms on standardized data collection tools.

In many situations, the performance level is a relevant symptom. Performance may need to be measured for individuals, units, channels, and systems. The expert system may need data on the following: growth measures, productivity, profitability, and quality. Examples of growth variables that may be relevant include total manpower, plant capacity, assets, sales, net profit, market shares, and the number of innovations/patents. In measuring profitability, it is necessary to examine ratios and trends, and compare them to historical, normative and competitor standards.

Information on organizational structures and functional relationships can provide symptomatic information. This symptom category includes data on types of manager-ial control, reporting relationships and communication links. Examination of structural relationships can also indicate organizational problems.

Measures of turnover and stability of a company's workforce or structures can of- ten indicate functional unit or system problems. For an expert system it may be necessary to measure turnover by skill category, time periods, as voluntary or involuntary, and as a percentage of the workforce.

Problems

The list of symptoms and problems is extensive in many domains. The following are examples of

problems in each of the 6 categories. Common problems of individual organization members/participants include apathy, poor training, low motivation, and conflict with co-workers. Team problems may include lack of cohesion, poor communication or ineffective processes or leadership. Functional departments/units may have staffing problems, high turnover or ineffective processes. Problems in a channel like an information system may include outdated technology, poor training, or complexity of policies. Organizational processes and systems may be overly bureaucratic, over- or understaffed, or poorly designed. Finally, environmental interactions can have many problems from poor coordination, misaligned goals, to different systems and processes.

Common organizational problems include 1) absence of clear direction, 2) personality clashes on teams, 3) lack of technical talent, limited subject-matter expertise, and leadership weaknesses, 4) poor communication, lack of open dialogue and limited feedback, and 5) lack of awareness of the organization culture and its environment (Stowell, 2019).

Treatments and Interventions

Specific treatments, remedial actions, and interventions can be related to each of the general management problem domains. An extensive literature exists on the possible uses and benefits of each of the treatments mentioned in the following paragraphs. In some cases, en-tire books have been written on the applications of a specific treatment like designing reward systems. Numerous interventions have been proposed for dealing with the problems of individuals in the organization (cf., Miner, 1980). A few examples include: providing job-specific training; linking pay to performance; counseling; goal-setting; punishments; and increased monitoring.

The type of unit where the problem exists will influence treatment selection and the generic labels for interventions directed toward functional units. Examples of these interventions might include staff expansion; changing substitutes for leadership; group counseling; and reorganization of authority relationships.
Interventions directed toward channels are often complex and difficult to implement. Examples of treatments may include: changing channel paths; improving the technology associated with a channel; expanding the capacity of a channel by in- creasing the number of personnel; creating redundancy in the channel; and reducing the length of a channel.

An intervention directed toward a system involves problems of individuals, functional units and channels. So, many of the above treatments may be used in conjunction with more system-wide interventions. Examples of system-wide interventions include Management by Objectives (MBO); improving forecasting; buffering production units; changing performance standards; changing operating technology; changing struc-tures; and changing reward rules and practices (cf., Gannon, 1977; Miner, 1982; Galbraith, 1977). Evidence-based treatment selection should be codified in

decision and production rules.

Decision Rules

The key to linking the symptom and treatment data and information reviewed in the previous sections is devel-oping decision or production rules (Pople, 1982). A decision rule maps observations of symptoms to an appropriate diagnosis and action. Rules specify how to choose among competing diagnoses and treatments. Production rules are used by an inference engine to draw deductions from data. Also, some type of pattern matching must be done by the system to control data gathering and to help draw inferences and reach conclusions.

Many rules need to be developed for management expert systems and knowledge-based systems (KBS) based upon research and evidence. For example, propagation rules are needed to determine what symptomatic information should be elicited, and in what order. Both backward and forward reasoning systems need rules for this purpose. An example of such a rule is: If profit trends indicate growth, then ask for industry data on profits. A number of facts may suggest routine sequences of questions that are relevant to a situation.

During the information gathering process, information must be aggregated by rules to test tentative diagnostic hypotheses and provide information to propagation rules, discussed in the previous paragraph. An example of this type of rule is: If sales growth is above the industry average, profit performance is substantially lower than the industry average, and the company is in a mature industry; then test the hypothesis that the company is overstaffed.

Rules are also needed to suggest starting points for search in more restricted solution spaces. For example, the statement of the major problem and setting factor data may be used to identify the most likely gross problem domain, or a subset of hypothesized problems from two or more domains.

Once data is collected, it must be used to test and compare competing diagnostic hypotheses. Differential diagnosis rules, cutoff scores, and other mechanisms need to be developed for use in rules. A differential diagnosis is a process of differentiating between two or more conditions/problems which share similar signs or symptoms. A differential diagnosis is required to recommend treatment(s).

Cost, implementation difficulty, organizational skills, as well as the tentative diagnosis, need to be

considered in rules that compare and recommend treatments. Also, a combination of treatments may be the best approach.

Finally, rules need to be developed that can recommend management interventions and treatments. Developing these treatment rules is a formidable challenge. Empirically verifying them will be time-consuming at best, and almost impossible in some cases. The rules may be based more on expert prescriptions.

Conclusions

Many difficulties will be encountered during the specification of knowledge bases for management expert systems and for knowledge-driven DSS. The preceding discussion demonstrates that management knowledge can be used in a formal diagnostic reasoning framework, but one unified, all-encompassing management expert system does not seem feasible at the present time. The information in the preceding sections does suggest that more specialized management expert systems can potentially be developed.

An organizational analysis expert system might focus on identifying problems in channels and specific organizational systems, like planning and control, general management, and personnel. An expert system that focuses on strategic analysis and environmental interactions may be feasible, but the recommendations from the system may be very general. The enormous amount of research on individual be-havior may lend itself to building an individual behavior analysis expert system. Also, specific expert systems for manufacturing companies that help managers diag- nose problems in the production system may be useful. Finally, a financial analy-sis expert system may provide valuable symptomatic information for other management expert systems. Different financial analysis expert systems for different purposes may be needed. It seems likely that specific benefits can be realized from expert systems in each of these five domains (cf., Goul, Shane & Tonge, 1984; Levine, 1983; Santhanam & Elam, 1998; Antony & Santhanam, 2007).

In developing these specialized systems, knowledge engineers should realize that there are many similarities and differences between organizational and human systems. Five major differences should especially be noted. First, there seem to be much greater differences in the gross structures of organizations than those of people. Second, the fundamental component of human systems, a cell, seems to have greater regularity and seems to be much better understood than its analogous component in organizations, the individual. Third, for each type of organization, e.g., multinational conglomerates, retail banks, and manufacturing companies, a relatively small number of them exist compared to human population subgroups. The smaller sample sizes limit our ability to discern statistically significant regularities. Also, there are problems in sharing information that make it difficult to develop knowledge bases.

Fourth, in diagnosing problems in human systems, the physician is more likely to be working in a crisis situation. The time available for diagnosis and treatment is often much greater in organizations. Also, much more time is required to collect data in an organization. So it may be easier for an organizational consultant to use diagnostic expert systems than it is for a physician. Finally, the concept of symptom and disease may be easier to define in medical diagnosis than management diagnosis. Managers often use a goal model, rather than a prob-lem or diagnostic model. Also, management research has often tested bivariate relationships and few attempts have been made to use prior research in a diagnostic reasoning framework.

Despite these potential problems and limitations, management diagnostic expert systems may allow consulting firms to provide services to more clients at a much lower cost. The cost would be lower because less skilled consultants could use the expert systems to guide them in their analyses. Also, the quality and accur-acy of the analyses and recommendations should be improved. Finally, the expert systems should help managers and consultants explain what is occurring, why, likely consequences, and possible interventions.

For management researchers, the possibilities seem promising and exciting. Much learning about the underlying structure of management knowledge may result. Also, attempting to fill gaps in the framework should yield fruitful research topics and practical knowledge.

The following issues should be addressed in future articles and research on this subject: 1. Can experts agree on diagnostic rules and a classifi- cation system? 2. Can a system be created that is compatible with how managers and consultants collect and process information? 3. Can questions be structured to elicit desired information from users? 4. How can causal relationships be represented? and 6. Is an expert system based on the symptoms, problems and treatment framework a practical means of supporting consultants and managers?

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